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reducing the size of the cotton crop. Of course, this action will lead to gyrations in the cotton market, higher cost to consumers, waste to everybody, and the marking of time in industrial development. But such unprecedented general price declines as occurred during the past year can lead only to the cessation of industrial development. It is tragic that we have not learned to avoid such general price changes, but industrial stagnation and maladjustment inevitably follow such price declines. The cotton grower has restricted production as an emergency measure, but the permanent solution of his difficulties must come through a decline in prices of his supplies or an advance in prices of his products. A re-alignment of prices in proper relation must be accomplished. Whether farm products will finally be adjusted upward, or other prices, wages, and rates adjusted downward, depends largely on what the general price level, or the purchasing power of our monetary unit finally becomes, and this problem is now largely under the control of the central banking system.

The prices of agricultural implements and many other manufactured articles are still far above the level of prices of farm products, and especially of cotton and cotton seed. The average price of farm products, as

reported by the Bureau of Labor Statistics for June, was only 13 per cent above the 1913 average, while the price of agricultural implements is more than double what it was in 1913. Cloths and clothing for May were 81 per cent above the 1913 average, fuel, 94 per cent, building materials, 102 per cent, and furniture and other house furnishings, 162 per cent. These prices must be reduced or prices of farm products will rise. The prices of both cotton and cotton seed are below the 1913 average. But if one may estimate the effect of scarcity on prices, it would not seem that either could long remain below the pre-war level while other prices remain so far above, especially if such shortage of cotton and cotton seed does occur as is now forecast.

The cotton grower has done what he can to re-align cotton prices in proper relation to other prices. He has succeeded temporarily, but the permanent solution must come through a readjustment of all prices on some level. At present that level seems uncertain. During the period of painful readjustment, a considerable portion of which seems to be in the future, higher prices for cotton must be paid; but when other prices become adjusted, cotton will again be produced at lower prices and in whatever amounts the world demands.

## The Automotive Industry

### A Study of the Facts of Automobile Production and Consumption in the United States

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**T**HE development of automotive transportation has been an economic achievement without parallel in the history of industry. In twenty-odd years, since its modest inception in

the late nineties, the automotive industry has revolutionized transportation on the highways, and has won, by merit of service, a position in the life of the nation, that is second only to steel.

It has created utility and conferred benefit beyond estimate of value in social betterment and economic service. It has developed natural resources and promoted the arts of manufacture. It has introduced standardization and stimulated the science of production. It has been a powerful servant in national defense. It enjoys a degree of popularity and sound good will that has never been experienced by any other industry. Directly and indirectly, it has supported the employment of 7,250,000 workers, and has become so closely woven into the fabric of our industrial life that its welfare involves to no small extent the welfare of the nation.

Boundless enthusiasm and optimism have played leading rôles in this spectacular development. The genius, endurance and tireless activity of an army of pioneers has conceived improvements, fostered progress in the technique of design and construction, created demand, established markets and laid the foundation upon which a giant industry has been erected.

At the conclusion of six years of unparalleled expansion and prosperity, the automotive industry, in common with all national businesses, is acutely depressed. A situation has been precipitated which must inevitably have developed as the industry approached maturity, but which might have been delayed and mitigated under more favorable circumstances. Its discipline might have been rendered less drastic if applied during a period of general prosperity and normal development, but it could not have been avoided or evaded under any circumstances.

#### A READJUSTMENT PERIOD INEVITABLE

In all progress there must be periods for consolidation of gains, recognition of errors, recasting of policy and adjustment to controlling conditions. What-

ever the normal evolution of the automotive industry might have been under other conditions, it is undeniably confronted today, not only by a temporary impairment of the purchasing power of its market, but also, and with compelling effectiveness, by obstacles of primary magnitude created by its lack of mature consideration and restraint during a period of abnormal extravagance.

In technical performance, the service rendered by the industry has been magnificent. In merchandizing, it has very badly overshot the mark.

Its position may not be lightly disregarded, for a major portion of national wealth is involved and the stagnation of the industry retards the general recovery of all business. When and under what circumstances and to what extent may the industry anticipate relief?

Undoubtedly a bright future lies ahead of the industry; perhaps not the pot of gold at the end of the rainbow, claimed by some, but certainly an adequate reward for service rendered.

#### REVIVAL OF THE AUTOMOTIVE INDUSTRY DEPENDENT ON RECOGNITION OF THE LAW OF SUPPLY AND DEMAND

Resumption of general activity in the automotive industry is only partly dependent upon recovery of general business. A great task of reconstruction is involved, which depends primarily upon open-minded recognition of the existence and controlling effect of numerous complex economic factors which have been totally disregarded during the recent period of abnormal inflation, if considered at all, and, subsequently, upon the rational and courageous solution of the problems created by these underlying and limiting influences, which constitute the general situation confronting manufacturers and distributors today.

Perhaps the greatest problem in this

situation is that of self-education in primary economics. During the entire history of its development, the automotive industry has lived in a world apart, and constituted a law unto itself. A primary obstacle to its recovery will be the fact that a great majority of the personnel of the industry, particularly its distributors, cannot believe, or will not admit that the law of supply and demand has any application to control of expenditure of the funds necessary to create and maintain automotive transportation.

The industry must be made to realize that the power of self-assertion has its limitations, before appreciable recovery can be expected. It will recover and progress, not because the world owes it a living, but because, and not until, it accurately surveys its market, adjusts itself to a basis of operation that balances supply to demand and extends demand to maximum volume by creating an extension in the utility of its product. It cannot pull itself up by its bootstraps through optimistic publicity and misrepresentation, and will find it foolish and a waste of time to challenge facts.

There is so much of real worth in the service rendered by automotive transportation, that the executives of the industry will serve their own best interest by realizing the necessity for stripping it of obstacles that impede its progress. The industry itself should encourage and direct a searching examination of fundamentals, with willingness to be guided by sound diagnosis and to proceed with the least possible delay to the necessary adjustments of policy and method to the requirements of actual conditions, abandoning, if need be, the dream of world conquest, in order to minimize the accumulation of losses resulting from unbalanced production, misdirected distribution and idle excess investment.

A thorough survey will prove to be a task of no mean magnitude. It is totally beyond the scope of this discussion to attempt more than a brief analysis of average conditions affecting the industry as a whole. It is realized that the actual individual experience of any particular element of the industry will necessarily vary from general conclusions, but the grand total effect upon national economics will be determined by the average experience of the entire industry, and it is from this viewpoint that the subject is approached.

The progress of civilization has demanded automotive transportation. It has been supplied, and due recognition must be accorded to the excellence of the service rendered by the automobile, as well as to the marvelous growth of the industry. Sincere consideration for the welfare of the industry may dictate the kindest expressions of goodwill, and suggest telepathy instead of surgery, but its stability and prosperity will be determined by economic factors and not by aspiration.

#### ACTUAL PRODUCTION NOT AN INDEX OF THE POTENTIAL MARKET—THE LAW OF BALANCED CONSUMPTION

However much the wish may be father to the thought, it would be a serious and disastrous fallacy to conclude that the volume of production reached during 1920 is in itself an index of the extent of the potential market. It is not a criterion by which the economic stability of the industry or the utility of its products may be gauged. A close comparative examination of the rate of consumption of wealth required to create and maintain automotive transportation in relation to the amount of wealth properly available for the purpose is also needed. Even then due provision must be made for an adequate prior distribution of the total annual production of wealth among

activities primarily essential to continuity of existence, comfort and protection.

The welfare and continued existence of society is dependent upon the extent of its production and the manner of its distribution of wealth. There must be a rational balance in the consumption of wealth, as it is distributed between essential and non-essential activities, and if there is to be continued progress in civilization, there must be conserved from current production a normal accretion of wealth to increase the total capital, with which future production and the promotion of public works may be increased. In other words, society would ultimately find itself unable to continue the purchase of unlimited quantities of vehicles if the diversion of labor and capital from essential production in order to create and maintain automotive transportation should constitute such a drain upon its resources of productive energy as to restrict the production and distribution of food-stuffs, clothing, housing and other similar commodities to the point of discomfort or abnegation.

The consumption of a previously acquired surplus may permit a temporary expenditure in excess of current income, but only to the extent of the surplus accumulated. Any excess expenditure impairs capital, and a heavy drain upon capital not only retards future development, but, if carried far enough, will restrict current production as well. Carrying this thought to its extreme limit, purely as an

illustration for the purpose of this discussion, an indefinitely continued expenditure in excess of current production would result in the destruction of all capital and cause reversion to primeval standards of living and conditions of labor.

#### THE STANDARD FOR GAUGING THE AUTOMOTIVE INDUSTRY

It should be obvious, therefore, that the criterion by which stability must be gauged is the adequacy of the return to the capital invested in the industry afforded by such portion of the average annual production of wealth as may properly be available for the purpose, after due allowance has been made for essential expenditures and normal savings. The present inquiry is predicated upon an assumption of the accuracy of this proposition.

#### OUTSTANDING FACTS OF PRODUCTION AND COST

Before proceeding with an analysis of the situation, it is of interest to estimate the magnitude of the industry. In 1920 its outstanding indices were as indicated in the table below.

It is of interest to note that the expenditure for automotive transportation is 15.4 per cent of the total annual production of wealth, and represents a sum 65 per cent greater than the amount needed to finance the government and the public debt.

The actual number of vehicles produced in 1920 was 2,205,197 and plant extensions under construction at the

Wealth consumed by automotive transportation . . . . .	\$8,167,850,000
Total annual production of wealth . . . . .	\$53,000,000,000
Vehicles in operation . . . . .	9,211,295
Mileage operated . . . . .	63,000,000,000
Average cost per mile . . . . .	12.96 cents
Average cost per mile by public utility . . . . .	3.50 cents
Number of manufacturers . . . . .	320
Number of distributors and service stations . . . . .	66,416
Capital invested . . . . .	\$2,126,717,377

peak of the market, completed since August, 1920, have undoubtedly added sufficient capacity to provide for the production of a total of 2,500,000 vehicles per year.

#### AN ANALYSIS OF COSTS IN TERMS OF FORD CARS

It may be granted that vehicles have been developed which function with every element of satisfaction, but before attempting to reach a conclusion relative to the extent of the demand for such vehicles, it is necessary to determine the least cost of operation of the most economical type produced, the amount of income which provides a margin sufficient to support this cost, the number of individuals possessing incomes equal to, or in excess of this limiting amount, the average life of such vehicles and the replacement requirements based on the assumption that every individual possessing sufficient income actually owns and operates a car. In addition to this replacement demand, allowances must be made for the use of cars by corporations, taxicab and bus lines, for the use of trucks and for the export of motor vehicles.

Excluding consideration of motor-cycles, the least expensive type of vehicle in use in the United States is the Ford, or equivalent. At the 1920 level of prices, the cost per mile to operate a Ford, as it is used in agricultural districts, with maximum economy, is as follows:

Depreciation.....	1.26 cents
Tires.....	1.29 "
Gasoline.....	1.50 "
Oil.....	.15 "
Interest.....	.19 "
Maintenance.....	.32 "
<hr/>	
Total.....	4.71 cents

Allowances for garaging and road maintenance, also insurance and driv-

ers' wages have been omitted, as it is obvious that the farmer houses the vehicle in a barn, or lean-to shed that already exists for other purposes, and is subject to very moderate taxes, operates the car over roads which involve and certainly receive very little upkeep, does not insure the machine and drives the car himself.

This condition represents the most favorable assumption that can be allowed for the purpose of inquiry. Higher costs entering into calculations of volume would indicate a rapid curtailment in the extent of the potential market.

The average annual mileage per car derived from comparison of a total registration of 9,211,295 vehicles, with a total of 63,000,000,000 car miles per year, is evidently 6,840 miles per year, or 18.75 miles per day. These 6,840 miles at 4.71¢ = \$322 per year.

#### A FAMILY INCOME OF \$2000 A YEAR IS THE LOWEST THAT WILL SUPPORT AN AUTOMOBILE UNDER PRESENT COSTS

The Savings Bank Association of the State of New York has made a very comprehensive series of budgets for individuals and families in different income classes, in which a normal balance between essential expenditures, non-essential expenditures and savings has been estimated. While the separate budgets do not in all cases show progressively increasing allowances with increase of income, this is undoubtedly due to transition from one set of psychological characteristics to others in families of different social standing, with correspondingly different view points in regard to essential standards of living.

It will be of interest to anyone desiring complete information relative to detailed distribution of expenditures in different income classes to refer to

these budgets. They are so voluminous, however, that it is beyond the scope of this discussion to present more than a sufficient excerpt from these budgets to establish a fair conception of the margin of funds available for advancement and recreation, after provision for necessary living expenses and minimum saving. The following tabulation indicates the amounts available for advancement and recreation, and includes allowances for travel, car fare, gifts, charity, club dues, personal taxes, dentists' and doctors' services, newspapers and magazines, education, entertainment and amusement.

"Operating" includes shelter, light,

heat, fuel, housekeeping, supplies, water, telephone, domestic services, and laundry. "General" includes clothing, education, charity, amusements and health.

The National Industrial Conference Board quotes average expenditures for industrial families, as follows:

Food .....	43%
Shelter .....	18
Clothing .....	13
Fuel and light .....	6
Sundries .....	20

The Guaranty Trust Company quotes a survey made in Philadelphia in 1918 covering the expenditures of 260 fam-

ANNUAL INCOME	SINGLE INDIVIDUAL	FAMILY OF 2	FAMILY OF 3	FAMILY OF 4	FAMILY OF 5
\$900 .....	84	...	...	...	...
1200 .....	132	84	...	...	...
1500 .....	180	132	132	84	48
1800 .....	258	132	156	96	60
2100 .....	300	204	180	120	84
2400 .....	360	240	240	204	156
2700 .....	540	...	240	192	180
3000 .....	615	360	300	240	240
3300 .....	...	...	360	300	300
3600 .....	...	360	360	336	336
3900 .....	...	...	360	360	360
4200 .....	...	504	456	480	480
4500 .....	...	...	480	480	420
4800 .....	...	540	480	480	480
5400 .....	...	600	600	600	660
6000 .....	...	600	720	720	660

Babson reports the following distribution determined by the chairman of the National Budget Committee:

INCOME	FOOD	OPERATING	GENERAL	SAVINGS
\$1000 and under .....	30%	35%	25%	10%
\$1000-\$2000 .....	23%	35%	29%	13%
\$2000-\$3000 .....	20%	34%	28%	18%
\$3000-\$4000 .....	18%	32%	30%	20%
\$4000-\$5000 .....	16%	29%	29%	25%

ilies of five people each, with an average yearly income of \$1262 as follows:

Housing.....	14.1%
Fuel, heat and light.....	5.1
Food.....	44.1
Clothing.....	13.9
Help.....	2.6
Furniture, etc.....	2.8
Taxes, contributions, etc.....	2.0
Recreation.....	1.3
Reading.....	1.0
Insurance.....	3.2
Car Fare.....	2.5
Cleaning, supplies and service....	2.6
Miscellaneous.....	4.8
<b>TOTAL.....</b>	<b>100.0</b>

The U. S. Bureau of Labor Statistics reports expenditures during 1918-1919 for families averaging 4.9 persons, with incomes averaging \$1,434, as follows:

Food.....	38%
Shelter.....	13
Clothing.....	17
Fuel and light.....	5
Sundries.....	26

In view of the foregoing, together with other similar data, it takes quite a stretch of the imagination to concede that incomes as low as \$2,000 per year may provide a margin of 15 per cent or \$300 per year for recreational purposes, but in order to make due allowance for the strong hold which the automobile has upon the affection of the public, and to present as favorable a case as possible for the industry, \$2,000 per year is considered to be the lowest income that will support the most economical type of vehicle.

#### THE SATURATION POINT UNDER PRESENT COSTS OF OPERATING CARS

Income tax returns indicate the following number of individuals possessing incomes of \$2,000 and over:

1917.....	1,832,132
1918.....	2,928,998
1920 (Estimated).....	2,326,132

Assuming that prices and operating costs of automobiles shrink uniformly with wages, and that therefore the ratio between car registration for 1920 and the number of individuals with incomes of \$2,000 or more per year, as a potential market, remains constant as the level of prices, costs and wages sinks back to pre-war conditions, we find the following general condition:

Potential market for vehicles in private use.....	2,326,132
1918 corporations.....	317,579
Taxicabs and busses (estimated)	50,000

Total normal registration of passenger cars.....	2,693,711
1915 registration.....	2,445,664

While it is entirely a matter of opinion, it is probably safe to assume saturation has not been reached for trucks, and that 1920 registration is a fair index from which to calculate replacement demand. 1920 registration for trucks is reported to have been 990,000. It is also fair to make the same assumption for export. 1920 distribution was as follows:

Passenger cars.....	141,477
Trucks.....	29,288
<b>TOTAL.....</b>	<b>170,765</b>

A very comprehensive survey by *Colliers Weekly* establishes the average life of an automotive vehicle at 5.1 years. National Automobile Chamber of Commerce figures check within 1.5 per cent. It is therefore safe to assume average car life at 5 years.

The annual demand for replacement is then:

Passenger Cars.....	680,219
Domestic.....	538,742
Export.....	141,219
<b>TOTAL.....</b>	<b>680,219</b>



Trucks.....	227,288
Domestic.....	198,000
Export.....	29,288
TOTAL.....	227,288

Total of all vehicles. . . . . 907,507

The total production of vehicles for 1920 shows the following distribution:

Passenger cars.....	1,883,158
Trucks.....	322,039
TOTAL.....	2,205,197

#### OVER-PRODUCTION OF PASSENGER CARS

The normal demand for vehicles upon complete recovery is therefore apparently limited to:

Passenger cars....	36% of 1920 production
Trucks.....	70.60% of 1920 " "

It may be assumed that there is no appreciable excess of trucks. In the case of passenger cars, the situation is very different.

1920 Registration of passenger cars.....	8,221,297
Estimated normal registration	2,693,711
Excess.....	5,527,586

The rate of retirement from service, based on 5 years life, and the assumption that all cars registered in 1920 have been kept in operation at the same average annual mileage, is:

1921	1,493,617 cars	1916	Production
1922	1,740,792 "	1917	"
1923	926,388 "	1918	"
1924	1,657,652 "	1919	"
5,818,449 cars			

It would therefore appear that the market for passenger cars will be virtually nil until the fall of 1924, and that upon normal resumption at that time, the demand will not exceed 36 per cent of 1920 capacity.

The truck market should pick up, however, with resumption of general business, and reach 70.6 per cent of 1920 capacity.

Making no allowance for motorcycles, therefore, or for parts-manufacturers, distributors and service stations, approximately \$628,600,000 excess investment will ultimately have to be liquidated.

This conclusion is based upon the assumption that no modification of design or construction is made in the type of vehicle produced by the industry. Due consideration should, however, be given to the possibility of extending the utility of the automobile through modifications improving its economy, which would naturally very rapidly expand its volume.

#### POTENTIAL DEMAND UNDER REDUCED COST OF OPERATING CARS

For the purpose of inquiry, it is therefore in order to determine whether existing types of vehicles possess maximum utility, i.e., whether the net operating cost per mile has already been reduced to a minimum consistent with safety, comfort and performance. If the answer is affirmative, the situation offers no opportunity for improvement. If it is not, the doctrine of origin of species and survival of the fittest operating through unrestricted competition will result in modifications of design, selection and treatment of materials, and methods of construction that will produce vehicles which may be operated with maximum economy, at a price within the purchasing power of a sufficient number of individuals to insure a volume of production that will absorb a maximum proportion of the capacity of existing plants. This ultimate demand has its fixed limitation in the number of individuals possessing the amount of income at which the margin available for recreation disap-

pears. This occurs at approximately \$1,000 per year.

There are approximately 6,000,000 individuals in the United States possessing incomes of \$1,000 or more per year. On a five-year replacement basis, the maximum possible normal demand for passenger cars in private ownership then becomes 1,200,000 per year. The replacement of cars used by corporations, taxicab and bus lines amounts to 783,516, and export accounts for 141,477. The total distribution that could be attained at this absolute limit is then 1,414,477 vehicles per year or 75 per cent of 1920 production. This throws an interesting light on the amount of over-production at the recent peak of activity.

#### AUTOMOBILE COSTS AS RELATED TO THE NATIONAL INCOME

In order to gain some idea of the extent to which present costs may be decreased, it is necessary to consider the distribution of items in the grand total annual expenditure for automotive transportation. The following tabulation sets forth an analysis of the total:

Depreciation.....	\$1,900,000,000
Interest.....	285,000,000
Tires.....	1,131,000,000
Gasoline.....	1,237,500,000
Oil.....	123,750,000
Roads.....	720,000,000
Garaging (storage only) ..	756,000,000
Maintenance and supplies	950,000,000
Insurance.....	329,000,000
Drivers wages.....	735,600,000

TOTAL..... \$8,167,850,000

Analysis of the total annual production of wealth for 1920 shows the following distribution:

Farm Products.....	\$25,000,000,000
Manufactured Products ..	24,000,000,000
Minerals, Timber, Fisheries, etc.....	4,000,000,000

TOTAL..... \$53,000,000,000

It is of interest to visualize the extent to which labor is diverted from other channels of production to create and maintain automotive transportation.

All costs, in the last analysis, are accumulated wages. An analysis of the total expenditure shows:

Total annual expenditure, \$8,167,850,000.

Average laboring rate—1920, 45 cents per hour.

Total expenditure then equals 18,150,000,000 man hours per year.

The average working hours per year of 313 days at 8 hours are 2504.

The number of workers in full time employment equivalent to total expenditure is 7,250,000.

In other words, it has required 7,250,000 workers continuously employed, to keep 9,211,295 vehicles in operation. There are approximately 46,400,000 wage-earners employed in the United States. Approximately 16 per cent, therefore, are diverted from other channels of production. If this number were engaged in the production of foodstuffs, clothing, etc., they would account for an increase of approximately 18.5 per cent in the supply of essential commodities.

It is of interest to consider the use of automobiles in relation to the growth of the two major fields of production—manufacture and agriculture. The value of the annual production of farm products and manufactured products at different periods is reported in the table on page 116.

The period 1880–1900 indicates a parallel rate of growth during the twenty years preceding the use of automotive transportation. During this interval the value of both agricultural and manufactured products approximately doubled. The period 1900–1920 indicates a widely discrepant rate of growth in the twenty years during which automotive transportation has been introduced. The value of farm

YEAR	FARM PRODUCTS	MANUFACTURED PRODUCTS
1880 .....	2,200,000,000	5,400,000,000
1900 .....	4,400,000,000	11,400,000,000
1920 .....	25,000,000,000	24,000,000,000

products has increased 5.7 times, while that of manufactured products has again approximately only doubled, in spite of the fact that the value of all vehicles, accessories and supplies produced is included in the total reported for manufactured products.

Assuming the rate of increase of value of manufactured products to have been the normal index for both periods in proportion to increase of population and per capita circulation of currency, and the same to have been true of farm products from 1880 to 1900, we may assume that a normal rate of growth would have shown a value of farm products for 1920 of \$8,800,000,000. On this basis, we may consider approximately \$16,200,000,000 to represent an abnormal increase and assume that the increased production has been made possible through the use of automobiles.

It is undoubtedly true that, owing to lack of facilities for transportation by public utility in outlying districts, the automobile has made it possible to extend the radius of agricultural cultivation to distances much further removed from centers of collection and distribution of freights, and of passenger transportation by public utility than would have been possible without this means of transportation. The National Automobile Chamber of Commerce reports 34 per cent of total mileage to have been in districts where there is no other adequate communication.

It is of interest to note that the type of vehicle absorbed by agricultural districts is the light economical car of the Ford class.

Assuming that half the total mileage is made by Fords in agricultural districts, which is generally conceded to be true, and that the mile cost of a Ford, as used by the farmer, is 4.71 cents, we account for \$1,483,650,000 of the total expenditure for automotive transportation or 5.93 per cent of the wealth produced on farms.

By difference, we find a total expenditure of \$6,684,200,000 in manufacturing and residential districts or 27.85 per cent of the wealth produced in factories.

If the use of automobiles resulted in enough increase in production to justify its cost, we should find an abnormal increase in volume sufficient to absorb the cost of automotive transportation in manufacturing districts. As has previously been demonstrated, this is not the case. There has been no corresponding abnormal rate of increase in the value of manufactured products. It is therefore undoubtedly true that automotive vehicles have not justified their use on economic grounds, outside of agricultural districts. Except in isolated cases, they exist only for convenience, flexibility in transportation and pleasure, and must properly be counted luxuries. The passenger automobile and in many instances, also, the truck, is therefore to no small extent chargeable with responsibility for increase in the cost of living, so far as this is affected by the cost of manufactured products.

On the other hand, it is apparent that automotive transportation in agricultural districts possesses distinct utility. The margin of excess produc-

tion of farm products attributable to the use of automobiles is wide enough to support its pro rata quota of heavier and more expensive vehicles, and it is of interest to note that the farmer has in recent years begun to buy higher grade passenger cars, and to use the finest trucks.

#### CARS OF PRESENT TYPES TOO EXPENSIVE TO PERMIT DEMAND TO BE EQUATED WITH OUTPUT

In view of the foregoing, it is obviously true that the most economical cars possess distinct utility in but half the field of production and that, in general, existing types are still too expensive to be operated by a sufficient number of individuals to restore the volume required to absorb the capacity of the industry.

It has been shown that, at the extreme limit of normal demand for improved types, the total production would be limited to 75 per cent of 1920 capacity. This means that under the most favorable conditions competition will eliminate a sufficient number of the weakest manufacturers to aggregate a total capacity of 470,780 passenger cars and 94,751 trucks per year. If no improvement is shown in construction, the total elimination will be enormously greater. It is important to note that this condition can be offset only by increase of population and longer working hours and, as political pressure is being brought to bear to limit immigration and prevent lengthening of hours, the industry can anticipate no relief from external expansion of its market, but must rely entirely upon the efficacy of its own internal reconstruction.

As has been stated, only one condition can approximate maximum volume and that is the production of the least expensive and most economical cars.

The manufacturers who survive the existing depression will be the ones who achieve this result.

#### CAR DESIGN DEVELOPING IN WRONG DIRECTION

An examination of factors controlling price and economy in operation leads to the conclusion that a great deal may be accomplished in the way of improvement by reduction of weight to a minimum, by decrease of power to the normal requirements for propulsion at ordinary speeds, and by limitation of speeds.

These objectives, while accepted in principle, established in fact and widely advertised, have unfortunately not been generally applied in the practice of designing and manufacturing cars. An outstanding fact, attested by examination of specifications of current models is that 1921 cars are heavier, higher powered and operate at higher speeds than 1920 models—obviously a step in the wrong direction.

The curves on pages 118-124 are of interest in connection with an inquiry into the relation of weight to economy.

Commenting upon the extreme variation in prices and operating costs shown by these curves, it is of interest to note that the National Automobile Chamber of Commerce admits that lighter and more economical cars can be produced, and will be produced when it is necessary for the industry to do so.

The one outlet for excess capacity is through production for export. If we are manufacturing cars which are not sufficiently economical to warrant their indefinitely continued use in the United States, how can we expect to export them to countries where the cost of petrol is prohibitive, per capita wealth and income are so much lower and an adverse price differential has been set up against us by depreciated exchange?

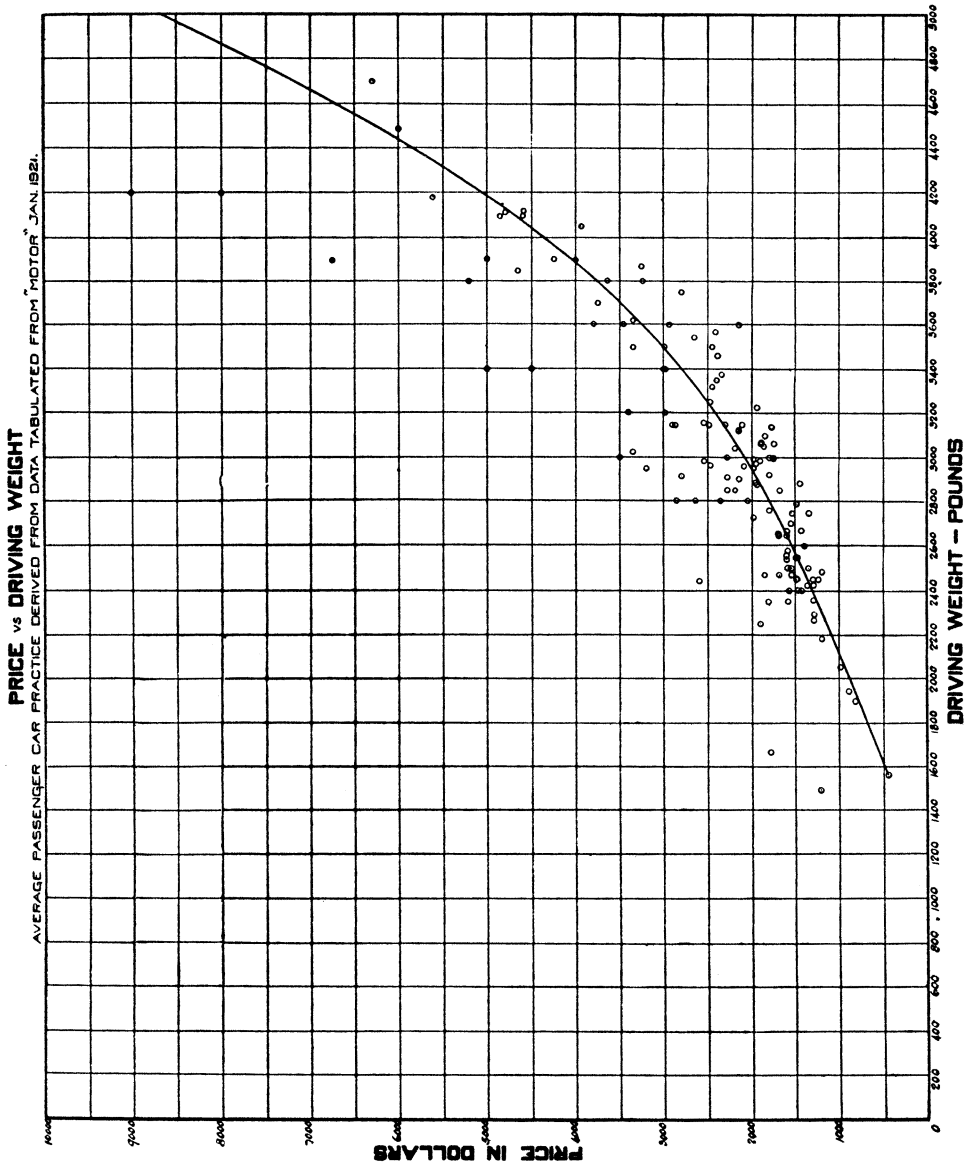


FIGURE 1

In the weight range from Ford at 1,600 pounds, to average weights for other models 3,040 pounds, the variation of price with weight is approximately \$1.00 per pound.

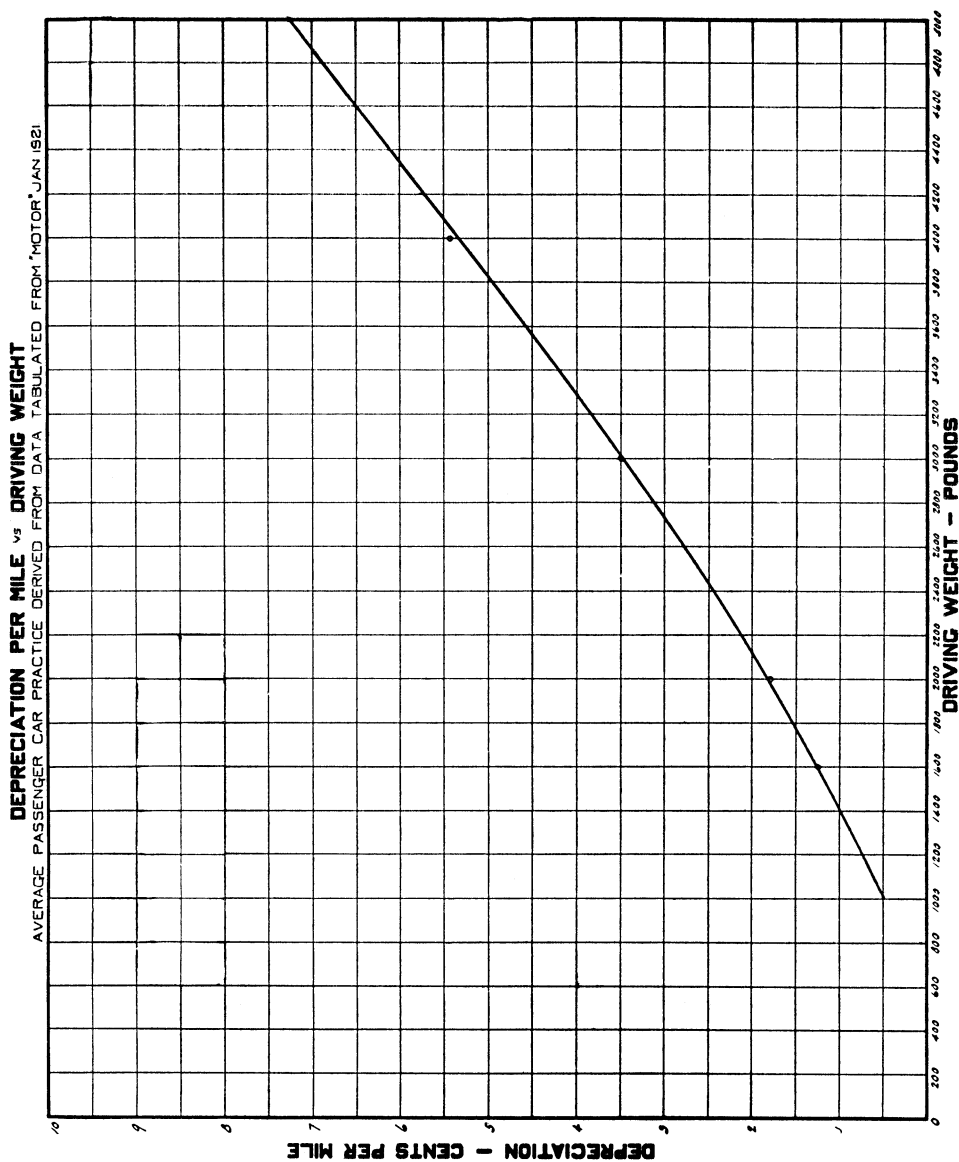


FIGURE 2

Based on 40,000 miles life of 1600 lb. car

50,000	"	"	"	2000	"	"
60,000	"	"	"	3000	"	"
80,000	"	"	"	4000	"	"
120,000	"	"	"	5000	"	"

It should be noted that these mileages are extremely favorable to the automobile, actual mass total experience indicates an average life of 35,000 miles.

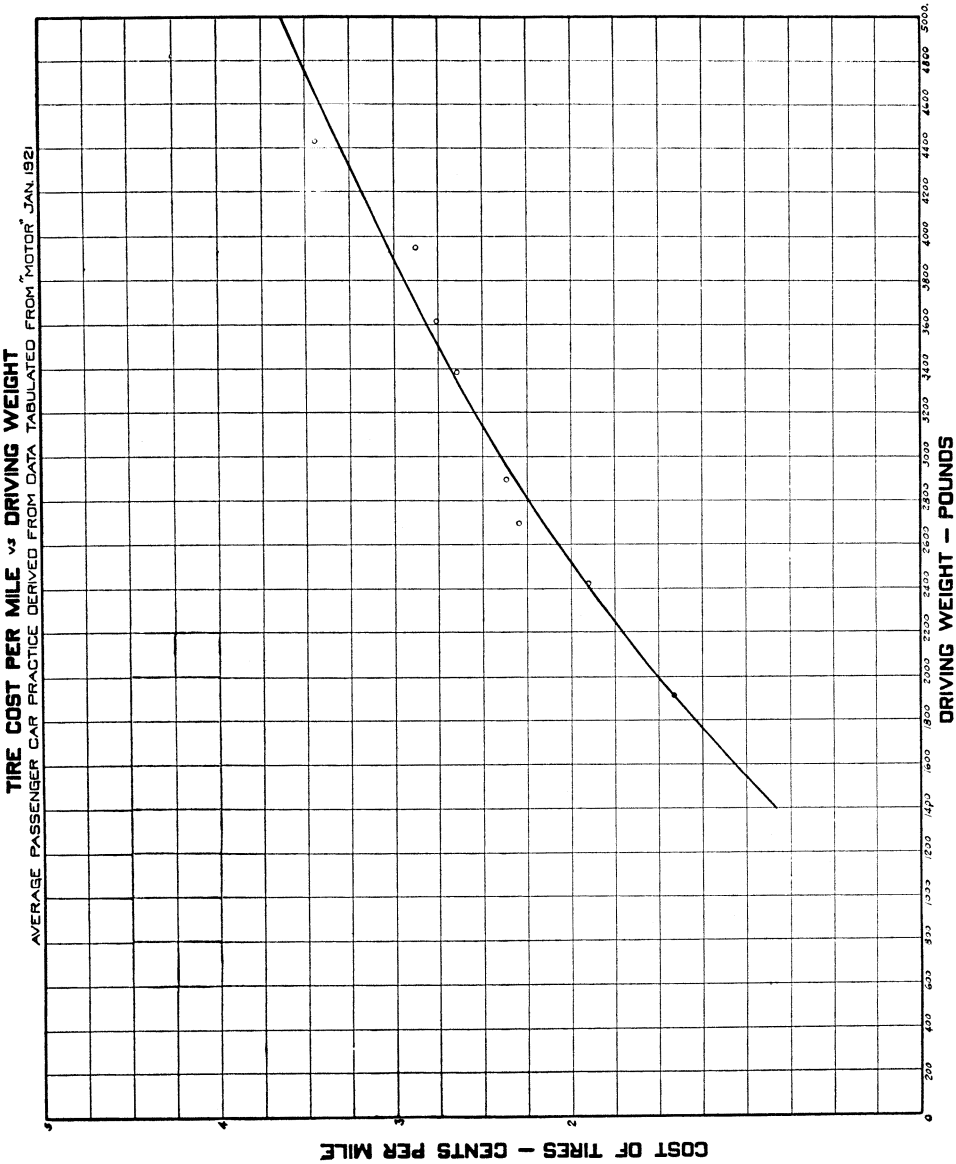


FIGURE 3

Cost per Set

\$90.20	30" x 3½" Fabric	7 cars averaging 1910 lbs.	7000 miles
108.60	32" x 3½" "	10 " "	2437 " 7000 "
222.60	31" x 4 " Cord	3 " "	2355 " 10,000 "
230.20	32" x 4 " "	41 " "	2696 " " "
237.40	33" x 4 " "	24 " "	2889 " " "
263.00	32" x 4½" "	29 " "	2445 " " "
269.40	33" x 4½" "	10 " "	3240 " " "
276.40	34" x 4½" "	12 " "	3619 " " "
287.20	33" x 5 " "	7 " "	3954 " " "
244.00	35" x 5 " "	9 " "	4436 " " "
	35" x 5½" "	1 car "	4050 " " "

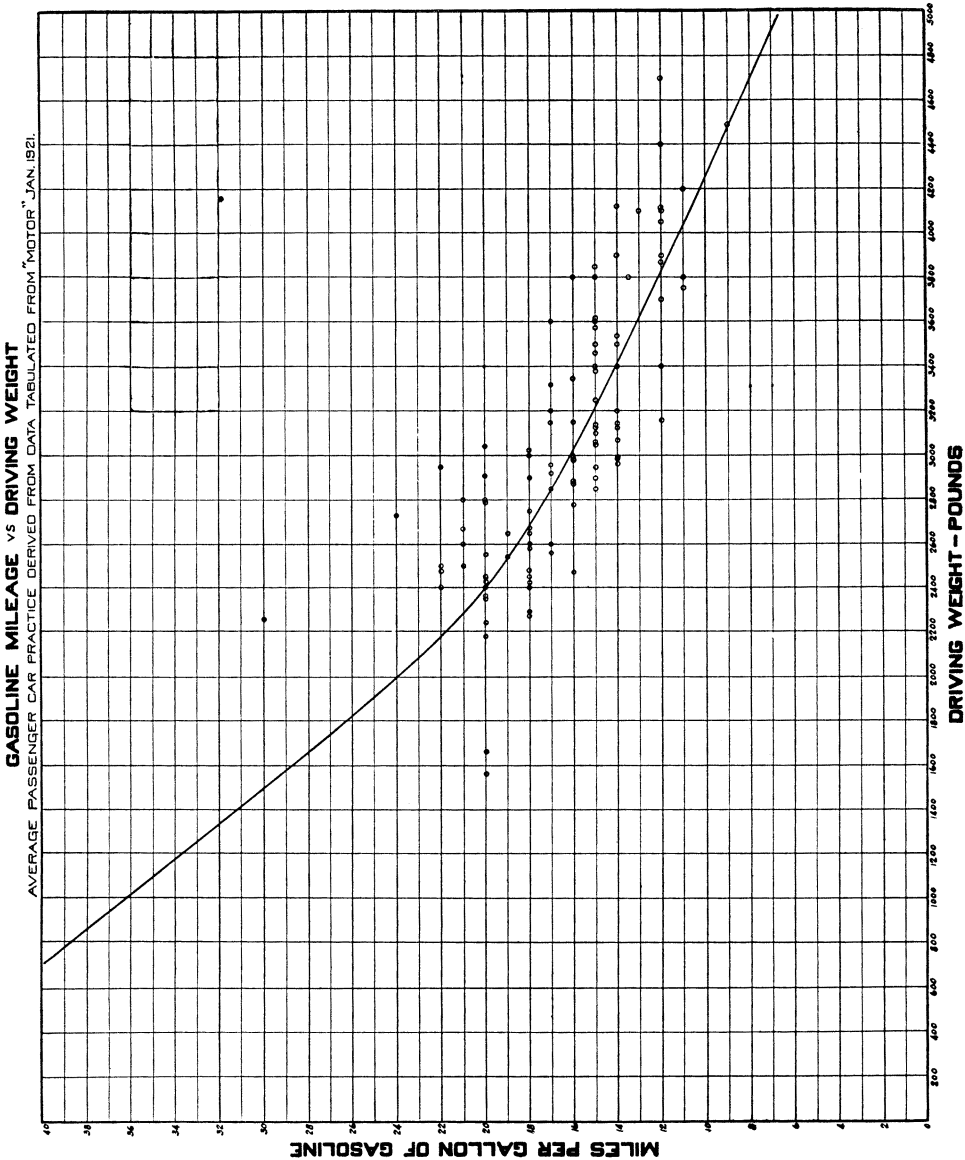


FIGURE 4

1 car	1900 lbs.	30	miles to gallon	10 cars ave.	3028 lbs.	16	miles to gallon
1 "	2250 "	25	" " "	20 "	3308 "	15	" " "
1 "	2730 "	24	" " "	13 "	3342 "	14	" " "
4 cars ave.	2583 "	22	" " "	1 "	3800 "	13½	" " "
4 "	2643 "	21	" " "	1 "	4100 "	13	" " "
16 "	2473 "	20	" " "	11 "	3936 "	12	" " "
2 "	2595 "	19	" " "	4 "	3990 "	11	" " "
18 "	2613 "	18	" " "	1 "	4490 "	9	" " "
9 "	3016 "	17	" " "				



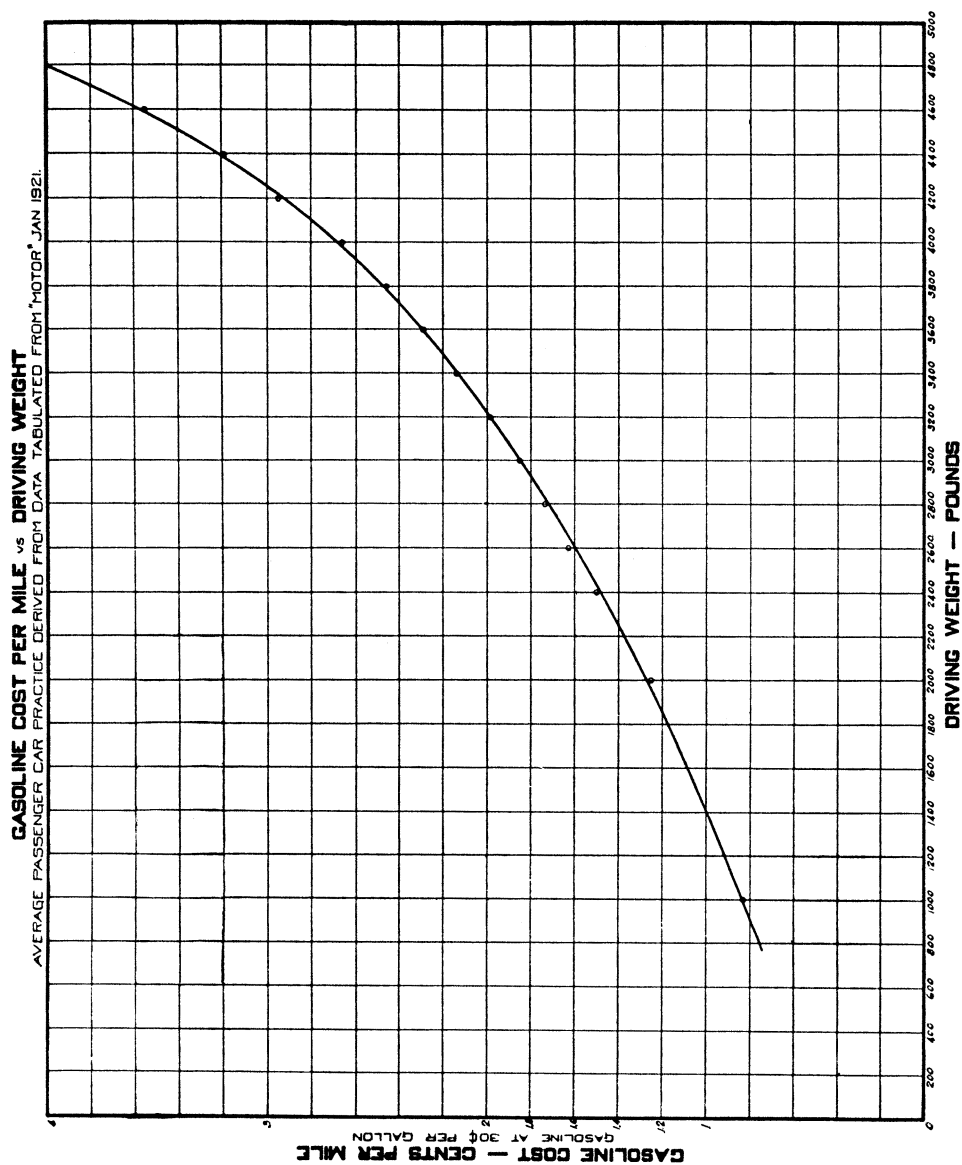


FIGURE 5

Derived from gasoline mileage vs. driving weight.

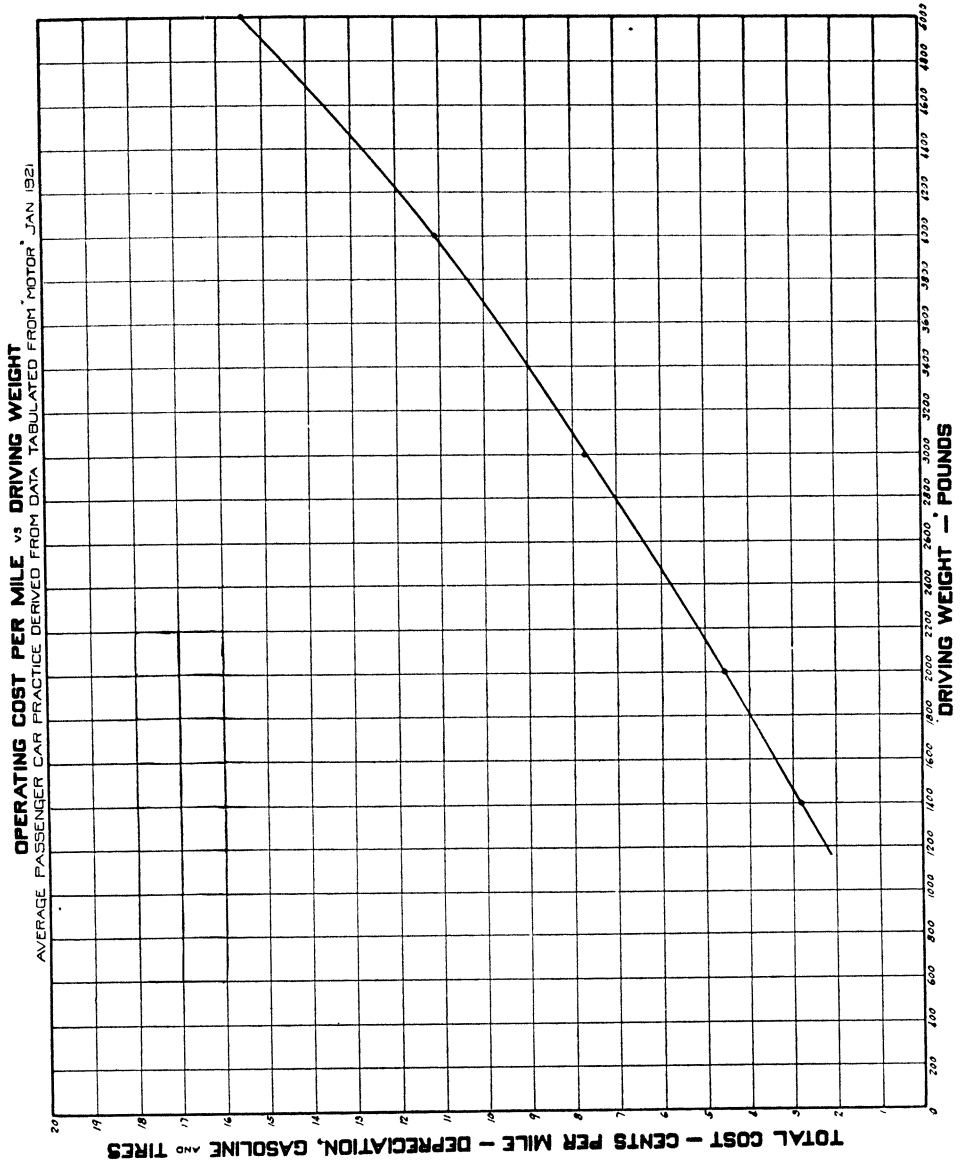


FIGURE 6  
Summation of preceding curves.

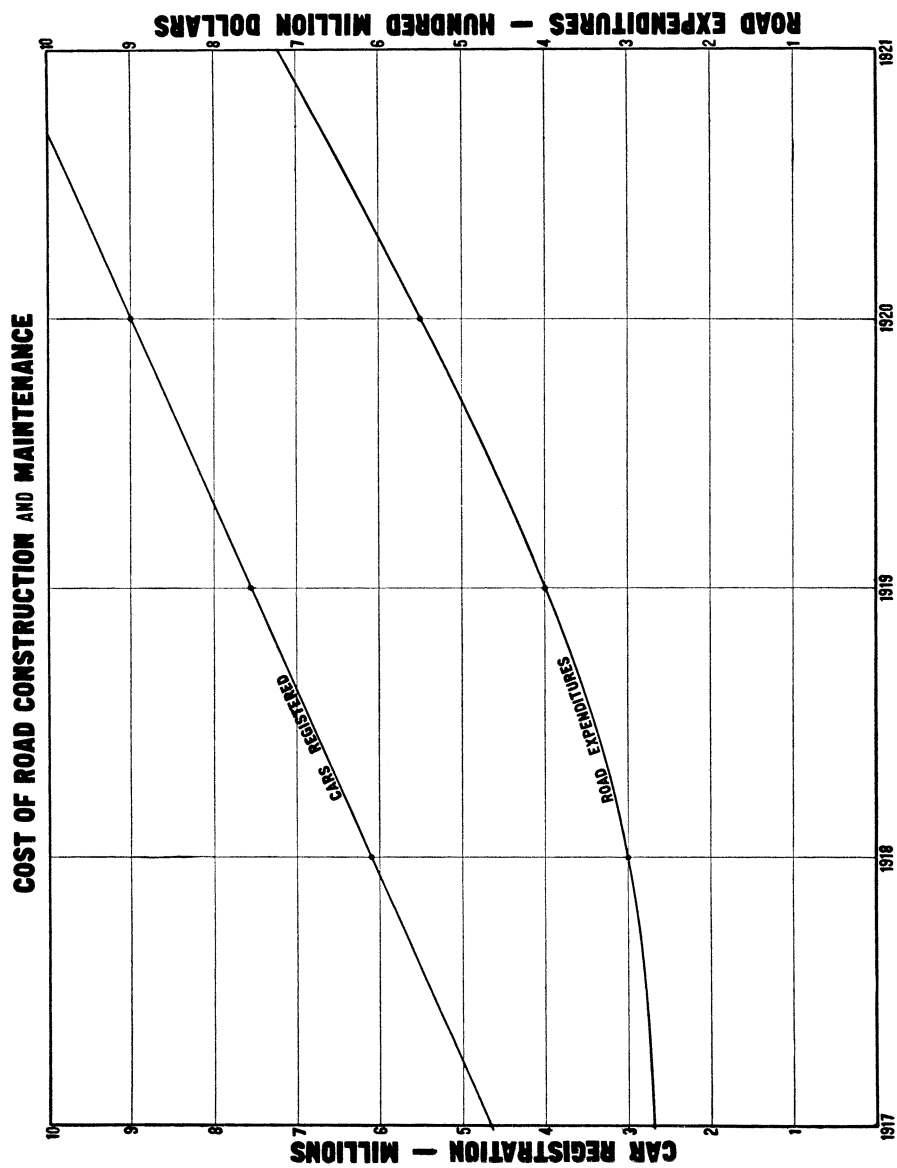


FIGURE 7

YEAR	EXPENDITURE FOR ROADS	CARS REGISTERED	PER CAR
1914.....	\$235,000,000	1,754,570	
1918.....	\$300,000,000	6,146,617	\$48.80
1919.....	\$400,000,000	7,523,664	\$53.20
1920.....	.....	9,211,295	\$61.10
1921.....	\$720,000,000	.....	\$70.00

### ECONOMY OF OPERATION SACRIFICED FOR POWER AND WEIGHT

A careful examination of the foregoing charts, together with detailed specifications listed at length in the statistical numbers of the leading trade journals indicates that economy of operation has been sacrificed for power and weight. First cost has been unduly increased by provision of detailed equipment and finish, tending toward a maximum of luxury in appointment and appearance.

The latter contribute entirely toward pride of possession, and do not in the slightest degree promote the mechanical efficiency of transportation. The former may be analyzed as follows:

"Power"—a large surplus of available capacity for development of mechanical energy over and above needs for propulsion at ordinary speeds. Provided for "pinch" purposes to avoid necessity for shifting gears. Excess utilized less than 1 per cent of driving time for extraordinary performance and acceleration in traffic, on bad roads, in informal road races and on hills. Results in 99 per cent operation at low thermal efficiency, with consequent wastage of gasoline under ordinary road conditions at usual touring speeds.

"Weight"—excess mass provided to give inertia in resistance to sudden accelerations and decelerations, contributing a sense of smoothness and stability in operation, and dampening the response to road shocks resulting from unnecessary speed. An expedient corrective for lack of driving skill in manipulation of clutch, accelerator, gear shift, and brakes, as well as failure to regulate driving speeds to road conditions.

While excess power and weight have contributed to spectacular performance

and have assisted publicity in promotion of sales for a time, has not the question been begged? Would it not have been better in the long run to have designed for economy in operation, refined our clutches and brakes and taught car operators how to drive?

### THE POSSIBILITY OF INCREASED GOVERNMENT REGULATION OF THE AUTOMOTIVE INDUSTRY

Even if commercial expediency had warranted the temporary exploitation of the automobile as a novelty with the understanding that it must ultimately be expected to repeat the history of the bicycle on a larger scale, and if, under the circumstances, costs had been so fully amortized in current production that the industry could face with complacency the abandonment of some portion of its capital investments or their diversion to other uses on shrinkage of demand to normal volume, could the industry expect to escape compulsory legislation in the end, if it failed of its own volition to design for economy?

It seems short-sighted to overlook the potential political effect of an ever and rapidly increasing burden for construction and maintenance of roads. The public is already spending \$720,000,000 per year, approximately \$80 per vehicle, for this purpose. Car owners are paying \$98,000,000, or about \$11 per car in licenses. The non-car owning public is paying \$69 per car.

With approximately 30,000,000 qualified voters, averaging \$24 each per year, about 22,000,000 or 73 per cent of whom neither own nor drive cars but have to foot the bill, how long will compulsory legislation limiting vehicle weights and speeds be delayed? Road impact is most certainly a function of mass and velocity, and road failures are a function of impact. The conclusion is obvious.

### THE FUTURE OF THE AUTOMOTIVE INDUSTRY A MATTER OF THE SURVIVAL OF THE FITTEST

It would seem inescapable that the vehicles of the future as they evolve from present types in survival of the fittest will be those which furnish comfortable and safe transportation, with minimum cost per unit of service rendered, *i.e.* per passenger or ton mile, and the industry cannot count itself to be established on bed rock until this unit cost approximates the cost of equivalent service by public utility. It is true that some slight premium may be warranted for flexibility and privacy in the control of individual transportation.

It is also true that some individuals will always be able to finance the operation of a limited number of the most expensive and luxurious cars, and intermediate grades,—but the number of models and quantity of each which are produced will undoubtedly bear a fixed and definite relation to the number of individuals of higher incomes sufficient to support the cost of each such model.

It must also be conceded that, in some cases, service at any cost will warrant the use of the highest powered cars, in matters of life and death or protection, by physicians and hospitals, by fire and police departments and by the army, and also that cars of this character will be required for the transportation of mail and perishable goods, etc., but in general it can be conceded to be true that economy must be attained.

### STEPS NECESSARY FOR THE REVIVAL OF THE INDUSTRY

On careful consideration, it would seem that the first great step forward toward economy can be accomplished by adjustment of the basis of distribution, so that the average commission on

sales may be reduced from present figures, averaging 25 per cent to 30 per cent of list to a level more nearly commensurate with the fair cost of selling other commodities.

A second great step forward would be a change in service policy, so that the maintenance of cars in use might be handled promptly and efficiently on a narrow margin in order to encourage distribution instead of continuing service as a vehicle for an abnormal profit that will kill the goose that lays the golden egg.

Limitations of power and speed, decrease of weight and the general use of the highest grade of alloy steels throughout construction will lengthen vehicle life, decrease depreciation and minimize cost.

On the face of the situation, it would appear that the distribution of cars has been forced on an unwarranted basis, and that the industry has become very dangerously inflated. There are millions of cars in excess of normal requirements which will glut the market for months to come, until they are eventually worked out of service. Their existence will undoubtedly impede the sale of new cars through inability of distributors to finance "trade-ins" indefinitely, or to move used cars in the volume offered. The effect will be to depress or break prices and curtail production during a prolonged period, as previously estimated.

The surest markets and quickest recoveries should be experienced by a limited number of high grade cars, and by the most inexpensive and economical light weight vehicles. The intermediate group must look forward to a prolonged and difficult period of readjustment prior to recovery, with many instances of liquidation.

While it is possible and certainly highly desirable that an orderly readjustment may take place, with com-

binations and absorptions in which due regard is had to the respective equities of all interests involved, it is unfortunately highly improbable that this will be the case. It is practically certain that there will be the keenest competition for business, with ultimate survival by a relatively small group of large and aggressive manufacturers producing a limited number of models of light economical cars at low cost on a large volume basis, and a few small manufacturers producing a very limited quantity of high grade expensive cars.

It is most regrettable that so meritorious an achievement as the development of automotive transportation should have been marred by the misfortune of over-expansion. It is entirely natural that there should have been some lack of foresight. It is a trait inherent in human nature. The extent of its failure to perceive its limitations is the only criticism that may fairly be leveled at the industry, not its failure *per se*. To a considerable degree it should be recognized that the condition of unbelievable prosperity during the recent period of inflation unavoidably absorbed attention in matters of production and distribution to the exclusion of mature consideration and sound analysis.

To the end, therefore, that the stability and continuity of the automotive industry may be assured, that its investments may be safe-guarded and its personnel protected against deviations from normal progress, it is of fundamental importance that there should be an accurate determination of the market, adjustment of production to current demand, combination and consolidation of facilities for production, limitation of models for quantity production, redesign to promote simplicity and economy, recasting of distributing and service methods, reduction of prices to a minimum and an orderly

and voluntary liquidation of excess investment.

If these things are not accomplished, the industry will be restricted by the effects of legislative regulation, limited by the purchasing power of the market, checked by bankers withholding funds needed for expansion in legitimate instances and embarrassed by their withdrawal of current outstanding loans until the total capital invested in the industry is balanced by liquidation to the normal requirement for curtailed production.

As a result of the process of elimination of the least fit in the unrestricted competition of a buyers market, the principle of marginal utility will establish the level of prices set by the weakest survivor, for the entire industry. These being necessarily low enough to maintain the distribution of the least desirable car, will curtail to a minimum the profit on sales experienced by the industry as a whole.

#### CONCLUSION AS TO THE PROSPECTS OF THE AUTOMOTIVE INDUSTRY

In conclusion, it would seem that the automotive industry may anticipate recovery under the following general conditions.

*Passenger Cars.* Tapering increase from present volume to 36 per cent of 1920 production by fall of 1924. Low prices, narrow margins and heavy liquidation *ad interim*.

*Trucks.* Prompt recovery to 71 per cent of 1920 production upon resumption of general business. Close prices, moderate margins and appreciable liquidation in the interim.

*Parts, Accessories and Supplies* will follow trend of passenger cars and trucks.

The foregoing conclusions may be modified by the extent to which lighter and more economical vehicles are produced and distributing and service methods are modified.